OFFICE OF MANNED SPACE FLIGHT

APOLLO APPLICATIONS PROGRAM

PROGRAM DIRECTIVE NO. 3A

FLIGHT MISSION DIRECTIVE FOR AAP-1/AAP-2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D. C.

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.055 (Project)	DATE 12/30/66

SATURN/APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 3A

TO : Distribution

FROM: John H. Disher for
DIRECTOR, SAA PROGRAM

SUBJECT: Flight Mission Directive for Mission AAP-1/AAP-2

REF : (a) Apollo Flight Mission Assignments Directive M-D MA 500-11 dated November 1966

(b) Apollo Applications Planning Schedule ML-5B dated December 1966

(c) Apollo Program Directive No. 18 dated 5/4/66

(d) Apollo Test Requirements, NPC 500-10, dated 5/20/64

(e) Apollo Program Directive No. 6A dated 8/30/66

(f) Apollo Program Directive No. 15 dated 1/25/66

(g) Apollo Program Directive No. 16A dated 8/30/66

PURPOSE: This Directive defines AAP requirements and responsibilities in order to initiate those actions necessary in mission design, space vehicle modifications and tests, experiments, crew preparation, launch operations, communications, tracking, mission control and flight operations to provide the option to carry out the AAP mission described herein. This mission is scheduled for launch, Reference (b), in the event that the space vehicles assigned to AS 207 and 209 in Reference (a) are not required to support the mainline Apollo Program. This Directive supersedes SAA Program Directive No. 3 dated 9/13/66.

1.0 MISSION PURPOSE

The purposes of the AAP-1/AAP-2 Mission are as follows:

1.1 Conduct a low altitude, low inclination earth orbital mission with a crew of three men, open ended to 28 days duration using a spent S-IVB stage as an Orbital Workshop.

1.2 Provide for reactivation and reuse of the Orbital Workshop during subsequent missions occurring up to one year later.

1.3 Perform test operations with the Lunar Mapping and Survey System in earth orbit.

.4 Conduct in-flight experiments in the areas of science, applications, technology and engineering.

.5 Qualify man, evaluate his support requirements and determine human task performance capability on long duration manned space flight missions.

2.0 MISSION OBJECTIVES

.1 Primary Objectives: The primary objectives of Mission AAP-1/AAP-2 are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Demonstrate hard-dock of the CSM and LM&SS to the Multiple Docking Adapter of the S-IVB/Airlock.

b. Demonstrate passivation of the spent S-IVB stage and activation of the Workshop as a habitable space structure (M402 Experiment).

c. Determine the feasibility of operating the Orbital Workshop as a habitable space structure for a period of up to 28 days from the AAP-1 launch date through evaluation of CSM/S-IVB/Airlock/Multiple Docking Adapter to include the following:

(1) Subsystems performance

(2) Astronaut mobility and work capability in both intra- and extra-vehicular activity

d. Determine the CSM subsystems performance during space flight up to 28 days duration.

e. Evaluate space flight environmental effects on the crew of a mission duration up to 28 days.

f. Demonstrate the feasibility of extending CSM mission duration through the use of an external source of expendables.

g. Leave the Orbital Workshop and LM&SS docked in orbit for reactivation and reuse up to one year later.

h. Test the LM&SS photographic equipment and spacecraft subsystems in earth orbit for subsequent lunar mapping and survey missions.

i. Verify the ability of mission ground support systems to support mission activities of extended duration.

2.2 Secondary Objectives: The secondary objectives of Mission AAP-1/AAP-2 may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the mission rules. Specification of secondary objectives for assignment to each flight in AAP-1/AAP-2 is to be assigned in subsequent issues of this Directive from the list of MSFEB approved experiments attached as Appendix 1.

3.0 GENERAL FLIGHT PLAN

3.1 Launch Vehicle Powered Flights:

a. AAP-1, using L/V SA-207 to carry a manned CSM and an LM&SS module, will be launched from LC 34 at KSC at a time and azimuth to initially support an orbit suitable for the LM&SS tests at approximately 120 n.mi. altitude and to facilitate subsequent rendezvous with the Orbital Workshop on AAP-2.

b. AAP-2, using L/V SA-209 to carry an Airlock and a Multiple Docking Adapter, will be launched from LC 37B at KSC at a time and azimuth to facilitate rendezvous with the AAP-1 spacecraft. The launch profile will be designed to provide an orbit established for optimum payload at an altitude consistent with an orbital lifetime of at least one year after insertion.

3.2 Spacecraft Flight Profile: The AAP-1 spacecraft will be injected initially into an earth orbit at approximately 120 n.mi. altitude where the LM&SS operations will be conducted. When the LM&SS initial operations are completed (three to five days), the CSM and LM&SS will rendezvous with the Orbital Workshop. The LM&SS module will be docked radially to the Workshop for future reuse. The CSM will dock inline with the Workshop where the remainder of the 28-day mission will be devoted to Orbital Workshop operations and experiments. The CSM will then return to earth leaving the Orbital Workshop with the attached LM&SS module in earth orbit.

3.3 Interface with future AAP Missions: Since the plan for execution of primary mission objectives of AAP-3/AAP-4 will be constrained by the operational capability of the hardware placed in orbit by AAP-1/AAP-2, it is imperative that the following requirements be considered concomitantly with the AAP-2 S-IVB stage modifications and the Airlock/Multiple Docking Adapter design:

a. Revisitation by AAP-3/AAP-4.

b. Reactivation for a period up to 56 days of ECS and EPS systems.

c. Radial docking of a Lunar Module (ascent stage)/Apollo Telescope Mount (LM/ATM).

d. Accommodation of ancillary hardware for conduct of additional experiments carried on later missions.

3.4 Recovery:

a. Water recovery to be developed for the CM consistent with the above stated profile characteristics and the normal recovery constraints associated with the deployment of recovery forces and the local lighting conditions at the time of recovery.

3.5 Mission Support Requirements: These requirements will be supplied in a "Program Support Requirements" document to be issued by the Operations Support Office, Mission Operations, OMSF, not later than four months prior to launch.

4.0 CONFIGURATION

4.1 Configuration Management: Configuration management for standard Apollo hardware will be in accordance with Reference (c). Post-delivery modifications will not be made prior to a decision by the Associate Administrator for Manned Space Flight that AS 207 and 209 are not required to meet Apollo Program objectives. Configuration management for AAP peculiar hardware shall insure complete identification of all flight end item hardware.

4.2 Launch Vehicles: The AAP-1/AAP-2 launch vehicles will be those being developed for AS 207 and 209, modified only as required to permit accomplishment of the respective mission objectives.

4.3 Nose Cone: An Apollo AS 206 type nose cone which will provide an aerodynamic shroud during the powered portion of flight AAP-2 will be utilized. It will be separated from the orbital payload after injection into orbit.

4.4 Airlock/Multiple Docking Adapter: The Airlock/Multiple Docking Adapter will:

a. Provide access to the S-IVB after it is in orbit.

b. Provide a life support pressurization and environmental control system for itself and the S-IVB Workshop.

c. Carry consumables to extend the AAP-1/AAP-2 Mission to 28 days.

d. Provide a supplementary power generation and distribution system to support, as a minimum, one 28-day mission and one 56-day mission (AAP-3/AAP-4) with an intervening storage period of from three months to one year.

e. Provide for consumables distribution to the S-IVB Workshop, the CSM and the Lunar Module/Apollo Telescope Mount (to be launched on AAP-3/AAP-4) when hard docked to the Airlock/Multiple Docking Adapter.

f. Provide for experiment support for both the AAP-1 and 2 flights as well as that required for execution of AAP-3/AAP-4.

g. Carry instrumentation for operational evaluation of the Airlock/S-IVB Workshop as a habitable space structure.

h. Provide for storage of all experiments designated for transport therein.

i. Provide four radial docking ports as well as an inline port. These ports will permit radial docking to the Airlock of an LM&SS module, resupply provisions, and an LM/ATM. It will also provide for concurrent inline and radial docking to the Airlock by two CSM's.

j. Provide sufficient in-orbit monitoring and command capability for the storage period to determine equipment status.

4.5 Spacecraft: CSM 105 will be a standard Block II Apollo configuration modified to:

a. Provide electrical power to the Airlock.

b. Carry and support experiment hardware as required.

c. Exchange data with and provide attitude and command control, telemetry and navigation to the LM&SS after the CSM transposes and docks with the LM&SS.

d. Receive oxygen and hydrogen from the Airlock.

4.6 LM&SS: The LM&SS will consist of a Payload Module that contains the photographic systems. The Payload Module is flown in place of a Lunar Module and is attached to a rack structure that in turn is attached to the SLA during boost. It will contain its own power and environmental control.

5.0 SUPPORTING GROUND TEST CONSTRAINTS

Test program will be conducted in accordance with NPC 500-10 (Ref (d)) as modified by the SAA/Development/Test Directive (to be issued) and appropriate test specifications. Mission Requirements documents prepared by the centers in support of these missions will identify the test constraints which must be lifted prior to mission execution.

5.1 Qualification: All flight critical components of the spacecraft launch vehicles, nose cone, S-IVB/Airlock/Docking Adapter System, flight experiment hardware and associated support systems integrated with the S-IVB/Airlock/Docking Adapter complex which have not been flight tested will be ground qualified and/or certified prior to launch in accordance with program test specifications to achieve the primary objectives identified in paragraph 2.1 above.

.2 Launch Vehicles: The following flight stage and acceptance tests will be performed:

a. Manufacturing checkout of S-IB-207, S-IB-209, S-IVB-207, S-IVB-209 and IU's for 207 and 209.

b. Static test of S-IB-207, S-IB-209, S-IVB-207, and S-IVB-209.

c. Post static checkout of S-IB-207, S-IB-209, S-IVB-207, and S-IVB-209.

d. KSC inspection tests of S-IB-207, S-IB-209, S-IVB-207, S-IVB-209, and IU's for 207 and 209.

.3 Nose Cone: The following ground tests will be performed:

a. Structural verification tests

b. Factory acceptance tests

c. KSC inspection tests

.4 Airlock with Multiple Docking Adapter: The Airlock with Multiple Docking Adapter shall be fully qualified to support manned operations.

.5 AAP Experiments: The following ground tests will be performed:

a. Qualification tests for each experiment.

b. Factory checkout and acceptance test of experiment and associated support systems.

c. Payload integration tests of experiment and associated support systems with carriers.

d. KSC prelaunch tests.

.6 Spacecraft: The following major flight article ground tests will be performed on CSM 105:

a. Factory checkout and acceptance tests.

b. Qualification tests for all AAP peculiar subsystems modifications to verify operation for the AAP-1/AAP-2 Mission.

c. KSC prelaunch tests.

.7 LM&SS: The LM&SS shall be qualified for operation in earth orbit.

5.8 Prior Flight Missions: All launch vehicle spacecraft and nose cone test anomalies resulting from all previous missions which could degrade or interfere with primary objectives will be fully understood, explained and corrected prior to the launch of AAP-1 or AAP-2.

5.9 Design Certification Review (DCR): An AAP DCR will be conducted to certify all new hardware and all changes from the standard Apollo hardware (already certified in previously conducted DCR's) required for this mission. This review will also include certification of experiments likely to affect flight worthiness, manned flight safety and/or mission primary objectives. The DCR shall be in accordance with Apollo Program Directive No. 6A (Reference (e)) as to be modified for AAP.

.10 Certification: A Certification of Flight Worthiness (Reference (d)) for each stage, Airlock/Docking Adapter, IU, and module (including the S-IVB LH_2 tank as an inhabited structure) is required prior to shipment from the factory and after static firing if appropriate. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close-out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 (Reference (f)) as to be modified for AAP.

6.0 RELIABILITY AND QUALITY ASSURANCE

A Reliability and Quality Assurance Program will be conducted in accordance with a "Reliability and Quality Assurance Plan" to be issued by SAA, R&QA, OMSF.

7.0 RESPONSIBILITIES

7.1 MSF:

a. The Apollo Program Director is responsible for overall management of the Saturn IB vehicles, nose cone, LM&SS, and Apollo Block II spacecraft development, manufacturing and processing until they are released to the Apollo Applications Program.

b. The Saturn/Apollo Applications Director is responsible for overall management of the Apollo Applications Program to include:

(1) Definition of mission objectives

(2) Development and integration of experiment hardware

(3) Development of launch vehicle and spacecraft modification kits

(4) Integration of launch vehicle and spacecraft modification kits after the basic Apollo hardware is released to AAP.

(5) Flight hardware configuration

(6) Supporting ground test constraints

(7) Resolution of AAP peculiar prior flight test anomalies

(8) Integration and checkout of the space vehicle prior to launch

(9) Systems engineering for orbital module cluster configurations

(10) Flight readiness determination

c. The Director, Mission Operations, is responsible for coordination of all mission operations planning activity. The Mission Director is responsible for insuring that all requirements, plans, schedules, procedures and directives required to conduct the mission are generated and for the overall direction of mission operations activities including flight and mission planning, simulations, prelaunch demonstration tests and the conduct of the mission.

7.2 MSFC is responsible for:

a. Providing the AAP-1/AAP-2 launch vehicles and the associated ground support equipment to include checkout, acceptance and delivery to KSC.

b. The development of the LM&SS rack.

c. The Workshop (M-402 Experiment) and the S-IVB stage modifications and kits.

d. The development of assigned experiments, supporting hardware and associated GSE.

e. Integration of assigned experiments into the AAP-1 launch vehicle and for the development of integration related mission requirements.

f. Integration of all experiments designated for transport in the AAP-2 flight mission and for the development of integration related mission requirements.

g. Nose cone development and integration with the AAP-2 payload.

h. Conduct of guidance and control dynamics analyses for the ground launched space vehicle configuration and development of the requisite launch vehicle guidance and control capability.

i. Conduct of dynamics analyses, in coordination with MSC, for the space module cluster configuration as required for development of the Orbital Workshop (S-IVB spent stage).

j. Providing launch vehicle performance constraints, systems data, and guidance support to MSC for mission planning.

k. Providing technical support to MSC concerning Workshop/Airlock and experiment crew training and flight operations.

l. Providing technical support to KSC as required during the acceptance, modification, prelaunch checkout and the launch phases of each mission.

7.3 MSC is responsible for:

a. Providing the CSM for the AAP-1 Mission and for the associated spacecraft GSE.

b. Factory checkout and delivery of spacecraft modules and associated GSE.

c. Management of the LM&SS development (Reference (g)) and any modification kits required for the CSM and SLA to accomplish the mission objectives.

d. Development of the Airlock, associated GSE, and any modification kits required for the CSM, SLA, or Airlock to accomplish mission objectives.

e. Development of assigned experiments, supporting hardware and associated GSE.

f. Integration of the LM&SS experiment with the CSM and the conduct of LM&SS operations.

g. Conduct of dynamics analyses, in coordination with MSFC, for the space module cluster configuration as required for development of the Airlock, LM&SS and CSM.

h. Mission planning including mission design and the development of the astronaut flight plan with appropriate inputs from MSFC for the AAP-1/AAP-2 spacecraft, S-IVB Workshop, Airlock and Multiple Docking Adapter.

i. Flight control, experiment and recovery operations planning and execution.

j. Crew training.

k. Providing technical support to KSC as required during the acceptance, modification, checkout, prelaunch and launch phases of each mission.

7.4 KSC is responsible for:

a. Development and activation of the launch and checkout facilities for each mission.

b. GSE preparation and prelaunch checkout of the launch vehicles for each mission.

c. GSE preparation and prelaunch checkout of the spacecraft and experiment hardware for AAP-1.

d. Installation of MSC and MSFC supplied kits and conduct of Apollo hardware modifications as required for execution at the launch site.

e. GSE preparation and prelaunch checkout of the Airlock/Multiple Docking Adapter and experiment hardware for AAP-2.

f. Physically integrating and checking out the total space vehicle for each mission with technical support from MSFC and MSC as required.

g. Space vehicle launch operations for each mission.

h. Providing technical support as required to MSC and MSFC concerning Apollo airborne and GSE hardware modifications.

7.5 Assignment of center responsibilities for development of the Multiple Docking Adapter, associated GSE and modification kits is to be defined.

8.0 IMPLEMENTATION

MSFC, MSC and KSC shall develop mission requirement directives to implement the requirements stated herein. When approved by the SAA Program Director, the center mission requirement directives will form an integral part of this Directive.

Subsequent changes and future revisions to center mission requirement directives noted above which conflict with the requirements stated herein will require coordination between the centers and the review and approval of the Saturn/Apollo Applications Program Director. Other revisions to the center mission requirements directives will be coordinated between centers as required with ten copies submitted to the Director, Saturn/Apollo Applications Program, Code ML, for information.

APPENDIX 1

AAP-1 and AAP-2 Experiments

The experiments listed below have been approved by the MSFEB for execution on AAP missions in 1968. The experiments considered appropriate for assignment to AAP-1 and AAP-2 are as indicated. Firm assignments will be made on conclusion of compatibility studies now in progress.

a. AAP-1:

	Experiment Title	Development Center
(1) Technology		
*T002	Manned Navigation Sightings	MSC
(2) Science and Applications		
S009	Nuclear Emulsion	MSC
S065	Multiband Terrain Photography (Hand Held)	MSC
(3) Department of Defense		
D017	CO_2 Reduction (D16)	AF/MSFC

b. AAP-2:

	Experiment Title	Development Center
(1) Engineering		
M466	Suits	MSC
M469	ST-124 Removal and Disassembly	MSFC
M479	Zero-g Flammability	MSC
M486	Astronaut EVA Equipment	MSC
**M487	Habitability/Crew Quarters	MSFC/MSC
M488	High Pressure Gas Expulsion	MSC
M489	Heat Exchange Service	MSC
M492	Tube Joining in Space	MSFC
M493	Electron Beam Welding	MSFC

	Experiment Title	Development Center
(2) Medical		
*M018	Vectorcardiogram	MSC
M050	Metabolic Activity	MSC
M051	Cardiovascular Function Assessment	MSC
M052	Bone and Muscle Changes	MSC
M053	Human Vestibular Function	MSC
*M054	Neurological Study (EEG)	MSC
M055	Time and Motion Study	MSC
(3) DOD Technological		
***D012	Astronaut Maneuvering Unit	AF/MSFC
D018	Integrated Maintenance	AF/MSFC
D019	Suit Donning and Sleep Station Evaluation	AF/MSFC
D020	Alternate Restraints Evaluation	AF/MSFC
D021	Expandable Airlock Technology	AF/MSFC
D022	Expandable Structure for Recovery	AF/MSFC
(4) Technological		
T017	Meteoroid Impact & Erosion	MSC
T020	Jet Shoes	LaRC
T021	Meteoroid Velocity	MSC
T022	Heat Pipe	MSFC
T023	Surface Adsorbed Materials	MSFC

*Not yet approved by MSFEB. To be considered by MSFEB at January 1967 meeting.

**Elements of this experiment should be recognized as contributing to the accomplishment of primary objective 2.1.c.

***Not yet assigned for execution by AAP in 1968.

TRIBUTION:

F
ueller
P/Jones
/Bogart
/Bowman
Phillips
1/Schaibley
2/Keegan
3/McGregor
4/Turnock
5/Russell
6/Reiffel
)/Holcomb (5)
'/Seccomb (10)
:/White (7)
/Thompson (8)
'/Day (5)
'Armstrong
'Freitag
./Ashley
'Evans
'Coulter (2)
'Bollerud (2)
'McLaughlin
N/Alibrando
'Christenson (10)
'Lilly (2)
?/Rafel (2)
R/Johnson
/Cotton
R/Davis
/Gray (9)
)/Lord
E/Raffensperger
L/Culbertson
L/Beattie
X/George
X/Hall
X/Werner
Y/Dixon

ML/Mathews
MLD/Disher
ML-1/Levenson
MLV/Fero
MLA/Taylor
Andrews
Green
Hanes
Krueger
Lundholm
MLO/Edwards
Fordyce
Nolan
MLP/Field
Fahs
Lann
LeBert-Francis
Lewis
Lievens
Mason
Miller
Nicholas
VonSaunder
Williams
MLP-4/Koutsandreas
Craven
Kieffer
VanSchaack
Yetter
MLP-5/Poore
Little
Sprince
Sylvia
MLR/Cohen
MLS/Anderson
Havenstein
Feldman
Ferrara
Martersteck
McFarland

MLT/Savage
D'Onofrio
Albert
Bumgardner
LaRock
Marsh
Roberts
Sperry
Summerfelt
Allen
Christianson
Frandsen
Pruett
Wong

OSSA
S/Newell
SD/Cortright
SE/Garbarini
SV/Johnson
SM/Foster (5)
SL/Nicks
SS/Naugle
SG/Mitchell
SG/Forsythe
SA/Jaffe
SB/Reynolds

OART
R/Adams
R/Eggers
RD/Myers
RA/Harper
RB/Jones
RP/Tischler
RV/Ames
RE/Sullivan
RN/Finger
RND/Woodward
RNV/Novik (5)

OTDA

ΓΓ/Buckley
ΓΓD/Truszynski
ΓΓA/Morrison
ΓΓS/Pozinsky
ΓΓR/Bryant

GSFC

500/Covington
512/Roberts
513/Vonbun

KSC

DIR/Debus
DEP/Siepert
ADM/VanStaden
ΓΓEG/Knothe
INS/Sendler
DF/Hock (5)
DF/Raffaelli
END-11/Gottuso
PPR/Petrone
PPR-33/Harper (60)
(Data Manager)

MSC

AA/Gilruth
AB/Low
AD/West
CA/Thompson (5)
CA/Douglas
CA/Evans (5)
PA/Shea
EA/Faget
EX/Piland
ET/Stoney
ET23/Gartrell
FA/Kraft
GA/Slayton
AH/Berry
FA4/Fielder
BM6/Tash (60)
(Data Manager)

MSFC

DIR/von Braun
DEP-T/Rees
EX/Maus
I-DIR/O'Connor
I-S/AA-MGR/Belew (5)
I-S/AA/Reinartz
I-S/AA/Ferguson
I-S/AA/Ise
I-I/IB-MGR/James
I-V-MGR/Rudolph
I-S/AA-T/Chambers
R-RP/Stuhlinger
R-AS/Williams
R-AS/Clingman
R-AERO-D/Horn
I-DIR/Mrazek
I-MO/Speer
I-RM-M/Goldston (60)
(Data Manager)